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THE COMPARATIVE STUDY OF CANCER.

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By E. F. BASHFORD, M.D.,

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A FEW years ago Professor McFadyean was obliged to protest against the assertion of a distinguished member of the medical profession that cancer was a disease limited to man. Veterinarians have described in the domesticated mammals practically all the forms of malignant new growths recognised in man with the exception of what is known as deciduoma malignum or chorio-epithelioma, associated with pregnancy. It is also very doubtful if an authentic case of cancer of the uterus has been described in an animal.

It now seems probable that a liability to some form of cancer is one of the conditions under which the life of all vertebrates is passed. If allowance is made for variations in the minute and gross anatomy of the vertebrates, cancer presents the same fundamental characters in all the animals in which it occurs. It also exhibits a curious contrast to the infectious diseases common to man and animals, in that, with identity in the nature of the disease and in its manifestations in various species, there is an entire absence of transmissibility from an animal of one species to another individual of a strange species. Further cancer as cancer produces no symptoms which are peculiar to it, such as characterise the reaction of the tissues, or of the organism as a whole, to various infective agents.

We must therefore look upon the cases of cancer which present themselves sporadically in different vertebrates as having no connection with one another, as having arisen "de novo" in each individual in which they are found. These are some of the considerations which have sprung from studying cancer from the comparative standpoint, which, together with the results of experimental and biological investigations, promises to give a new impetus to the investigation of cancer. The problem as it presents itself at present is how, when, and why malignant new growths arise "de novo" in the course of the life of many vertebrates.

Benign new growths behave as independent parasitic organisms

Everything which characterises a benign new growth as an independent organism is also characteristic in enhanced degree of a malignant new growth. It is not proposed to discuss how and why malignant new growths arise, but only to draw your attention to the time when they come under observation, which of course may be a very different thing from the time at which they have arisen.

One of the fundamental characters of cancer, especially carcinoma, is that it shows a curious predilection for the later adult and old age periods of life in man and in all the various species of animals subject to it. Although this is now a well known fact, I venture to draw the attention of the veterinary profession to it, because associated with it there is a question to which only the veterinary profession, to the members of which the Imperial Cancer Research Fund is already greatly indebted, have the opportunity of giving the answer, by helping to accumulate the necessary facts.

The duration of life varies greatly in the species subject to cancer. Old age is therefore attained quickly or slowly, if the absolute number of years be considered. Cancer is an identical process in all animals, and shows itself at a time which is in direct proportion to the varying durations of life, and is therefore definite and different for each species. These relations of the cancer ages to the durations of the span of life indicate the important dependence of the development of malignant new growths as a whole, upon circumstances innate in each species of organism, and on the laws peculiar to and controlling their growth. At present we can only draw this general conclusion, and speculate as to its cause and its coincidence with the wane in reproductive activity.

We require more information. Even in the case of the most common domesticated mammals we have no data extensive enough to permit of an instructive comparison of the relative frequency with which different animals suffer, nor which allow us to single out the sites of greater susceptibility, or determine whether these are the same or different in various animals, and in the two sexes. Epithelioma is the form of new growth of which the Imperial Cancer Research Fund has received most specimens. Many of these have come from the horse, cattle, dog, cat; also from the hen, and some doubtful cases from the trout.

It appears to me, however, that one is not justified in assuming that epithelioma is relatively more frequent than other forms of cancer. The apparent frequency of epithelioma may be only a consequence of its occurring on surfaces where it is more easily observed than internal cancers which are only likely to be found in numbers when numerous post-

mortem examinations are made. This view receives some support from the fact that in the case of those domesticated mammals which are slaughtered for food and the carcasses submitted to meat inspection a larger number of internal cancers have been received. The noteworthy omission of the sheep, goat, and pig may not represent an insusceptibility to epithelioma in the case of these animals.

All the cases of epithelioma above referred to have been obtained from relatively old animals. All the tumours received by us from sheep, goat, pig have been from relatively young animals. In the case of the animals slaughtered for food, viz.: cattle, sheep, pigs, etc., for slaughtering they are preferred at the youngest age which yields profit, *e.g.*, 53,482 pigs were slaughtered in Glasgow in 1903. The average age of these was 6—12 months. No case of cancer was found. This does not prove that the pig is relatively exempt from cancer, and I put the question—will no case of cancer be found if the carcasses of 50,000 old pigs are examined with the same care? In the case of the cow, considerable numbers may be kept to higher ages for milking and breeding purposes by poorer people, *e.g.*, in Ireland. We can segregate cows into groups of younger and older animals, and where this segregation is possible, *e.g.*, in Glasgow, we find a preponderance of cancer in the latter group.

Is the presence or absence of a considerable proportion of middle-aged and old individuals the only factor which determines the frequency with which cancer occurs in different animals? Or are there really species of domesticated and wild animals among which even with a considerable proportion of aged individuals cancer is not to be found? If such animals exist, the reasons for their natural exemption, or for the natural exemption of any of their organs, from cancer may be of theoretical and practical importance.

Even in man, where cancer has been longest known and is still most frequently recorded, only a proportion of the total number of cases is recognised. This proportion approximates more nearly to the absolute number occurring, in accordance with the thoroughness with which cancer is looked for. Many cases are discovered only in consequence of post-mortem or microscopic examination. Under the conditions of human life it is unreasonable to expect that all cases of cancer will ever be brought to light, we have to be content with an approximation to the total, with the recorded frequency as distinct from the absolute frequency. Theoretically we could arrive at the absolute frequency were it possible to have such an extensive series of autopsies that the subjects could be distributed in the age proportions characteristic of a standard population.

In the case of domesticated animals, more especially those which are slaughtered for food, and therefore subjected to meat inspection, the machinery necessary to detect the absolute frequency of cancer among them already exists, if the meat inspectors and their assistants know how to recognise cancer. So far as I am aware the careful systematic meat inspection conducted under Mr. Trotter's direction has done more to give us a true idea of the relative frequency of cancer in animals slaughtered for food than the work in any other abattoir. Conditions which are impossible of attainment in the case of mankind are practically obligatory in the case of all animals slaughtered in public abattoirs where the carcasses are submitted to skilled post-mortem examination. The results obtained in the Moore Street Abattoir, Glasgow, under the able direction of Mr. A. M. Trotter, show that the machinery for meat inspection is sufficient to give most valuable information on the comparative age, sex, and organ incidence of cancer in *e.g.*, cattle, sheep, and pigs.

There is one other point on which skilled meat inspection can yield most valuable information. It is recognised that castration prevents the acquisition of the secondary sexual characters, prolongs the period of growth, and generally delays the tissue changes which distinguish younger from adult and older individuals. The sexual organs have a profound influence on the body, and it was natural that their possible influence on cancer should receive attention. Dr. Beatson, of Glasgow, was the first to perceive that the removal of the ovaries in inoperable cancer of the breast in women sometimes had a beneficial result. During the past year we have examined a number of cancers obtained from geldings, and from castrated or spayed cattle, dogs, and cats. This shows that the simple absence or presence of the *normal* internal secretion of the reproductive organs cannot determine the initiation of the cancer process, nor is the presence of an *abnormal* secretion by the reproductive organs a necessary preliminary condition. These possibilities are excluded by the occurrence of cancer both in the presence and in the absence of these organs themselves. I have already pointed out the curious coincidence between the time of the maximum tendency to cancer and the period of waning reproductive activity. This may or may not be only a coincidence. In the course of meat inspection it is possible to determine whether the age at which cancer tends to occur in spayed or castrated animals is earlier or later than in entire animals, and these data will give the first reliable indication of whether or not the reproductive organs exercise any influence in determining the coincidence of the higher cancer rate with later adult life.

The extent to which careful meat inspection in Glasgow and fish inspection in Nottingham and at Billingsgate have been responsible for the detection of cancer in animals destined for food consumption has been emphasised. There can be no doubt that the inspectors at abattoirs and fish and poultry markets will in future detect cancer and the facts associated with its occurrence more frequently if they will only look for it. The Imperial Cancer Research Fund will most willingly continue to examine and report on the nature of tumours from all animals if the age, sex, and animal are stated, together with information as to whether the animal was castrated or entire. In drawing special attention to the carcasses of animals killed for food, I should not omit to state that equal importance attaches to data from the horse, dog, cat, and any other animal whatsoever.

I have tried to point out to you some matters on which the veterinary profession can supply valuable information, and by doing so place the public and those whose duty it is to investigate the nature of cancer under great and lasting obligation. The members of the veterinary profession have the opportunity of obtaining this information, and that the present machinery is adequate to yield valuable results the facts brought to light in the Glasgow abattoirs have fully demonstrated. More extended observations of the same kind may contribute materially to the relief of human suffering.
